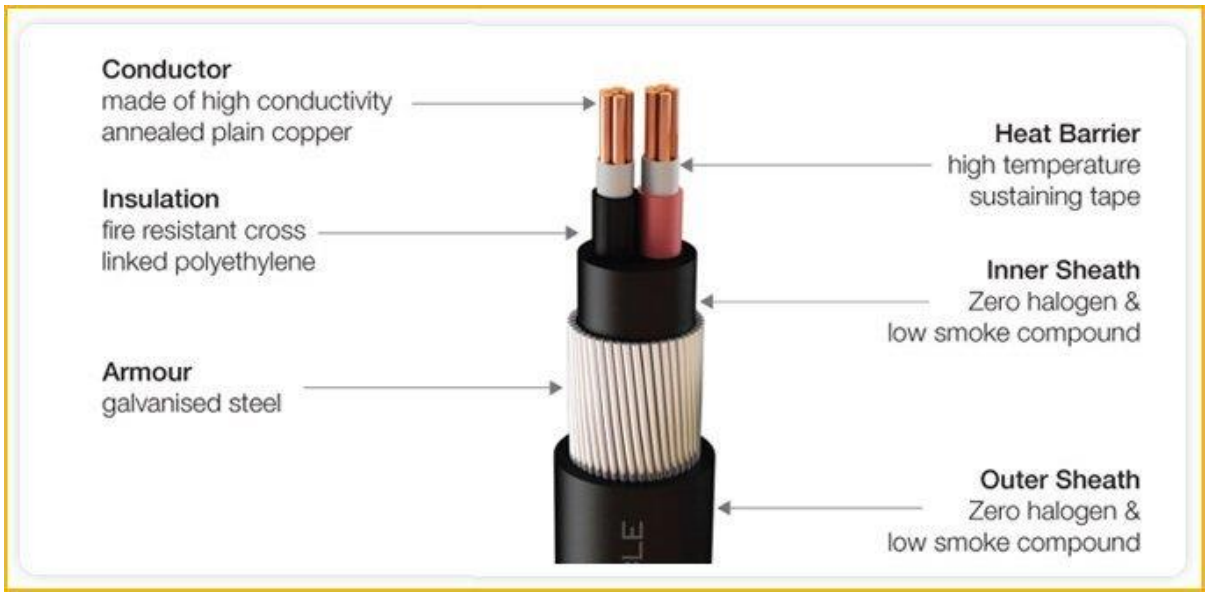
Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

A Fire-resistant cable is a cable that can maintain safe operation for a certain period under flame-burning conditions. Fire-resistant wires are widely used in high-rise buildings, subways, underground shopping malls, power stations, and important industrial and mining enterprises related to fire safety and fire rescue。 For example, power supply wires and control wires for fire fighting facilities.

1. What Is Fire Resistant Cable?

Fire-resistant cable is divided into class A and class B. Class B cable can be in 750 ℃ ~ 800 ℃ flame and rated voltage to withstand burning for at least 90min, and the cable is not broken. In the refractory layer to improve the manufacturing process and increase the refractory layer and other methods based on Class A fire rated cable development, it can be 950 ℃ ~ 1 000 ℃ flame and rated voltage to withstand burning for at least 90min and the cable is not punctured. Class A fire-resistant cable fire performance is better than class B. Also, mineral insulated cable is a better performance of fire-resistant cables made of copper core, copper sheath, magnesium oxide insulation material processing, referred to as MI (mineral insulated cables) cable. MI cable has good fire resistance characteristics and can work for a long time under 250 ℃ high temperature, but also explosion-proof, strong corrosion-resistance, high flow rate, radiation resistance MI cable has the characteristics of explosion-proof, high corrosion resistance, high current carrying capacity, radiation resistance, high mechanical strength, small size, lightweight, long life, and smokeless. However, the price is high. The process is complicated, the construction is difficult in the oil irrigation area, important wooden public buildings, high-temperature places, and other fire-resistant requirements, and the economy can accept the occasion and use fire-resistant cable.



2.Fire Resistant Cable Specification

The maximum long-term working temperature of the cable
(1) Resistant vinyl polyfluoroethylene insulation and sheath: 70℃ and 105℃ both kinds; Cross-linked polyethene insulation: 90℃.
(2) Fluoroplastic insulation and sheathing: 220℃ and 260℃ two kinds; Fluoroplastic insulation and 105℃ flame retardant polyvinyl fluoride sheathing: 90℃ and 125℃ two kinds.
(3) Low-halogen, low-smoke flame-retardant PVC insulation, and sheathing: 70℃; Halogen-free, low-smoke flame-retardant polyolefin insulation and sheathing: 90℃ and 125℃ both.

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

Minimum ambient temperature.

(1) Flame retardant PVC insulation and sheathing: fixed laying -40℃; non-fixed laying -15℃.
(2) Fluorine plastic insulation and sheathing: fixed laying -60℃; non-fixed laying -20℃.
The safe laying temperature of the cable should not be lower than 0℃.
Fire resistance characteristics.
Flame temperature 950℃-1000℃ Flame temperature 750℃-800℃
Burning time 90min (recommended) Burning time 90min (recommended)
Additional voltage Rated voltage (min. 100V) Rated voltage (min. 100V)
Fire resistance class A (Class IA~Class IVA) Class I~IV

2. Fire Resistant Cable Vs Flame Retardant.

Fire-resistant wires are a general term for wire and cable with fire performance, usually divided into the flame retardant wire and cable and fire-resistant wire and cable. It is easy for the general public to confuse flame retardant cables and IEC 60331 fire resistant cable.

However, flame retardant cables have many advantages that are more applicable to chemical companies, such as low halogen, low smoke flame retardant, etc. In general, fire rate_power cables can replace flame retardant cables, while flame retardant cables cannot replace fire resistant cables. The following is a brief introduction to their differences and features by ZW Cable.

Fire-resistant cable and flame retardant cable are not the same. The Halogen-containing cable flame retardant principle is to rely on the flame retardant effect of halogen. Halogen-free cable flame retardant principle is to rely on the precipitation of water to reduce the temperature to extinguish the fire roast. A Fire-resistant cable is to rely on the refractory layer of mica materials in the fire-resistant, heat-resistant properties to ensure that the cable works properly in the event of a fire.

As a new technology, the principle of the criticized cable, which is representative of fire-resistant cables, is that the cable can form a self-supporting ceramic body in the flame, which has a certain strength and can be used in the flame at a temperature of 650 to 1000°C and the cable will not be damaged. Therefore, the fire-resistant cable produces little smoke in the fire, and there is no halogen which is of great help to the environment. And the cable is easy to install, so many customers are willing to buy it.

Fire-resistant cables and flame-retardant cables are different in structure and materials.

The basic structure of the flame retardant cable is:

- The insulation layer uses flame retardant.
- The inner sheath and outer sheath are made of flame retardant.
- The tape and filling use of flame retardant material.

A fireproof cable is to add another layer of fire-resistant layer between the conductor and the insulation. You can add a fire-resistant layer to the structure of fire-resistant cables, forming both fire-resistant and fire-resistant cables, but in practice, there is no need for this. Because the refractory layer of the fire-resistant cable can usually be wrapped directly on the wire using different fire-resistant materials. It can resist burning for a long time and can ensure the line's normal operation even if the polymer at the applied flame is burned.
Flame-retardant wires are characterized by delaying the spread of flame along the cable so that the fire does not expand. Because of its lower cost, it is fire-resistant cable sales very good.

Fire-resistant cables can maintain normal operation for a certain period under flame burning conditions and maintain the line's integrity. The amount of smoke produced when burning fire-resistant cable is less, especially with refractory materials, making fire-resistant flame retardant performance, especially in the case of burning, accompanied by water sprinkling and fire fighting, the cable can still maintain the integrity of the wire operation.

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

4.Where To Buy Fire Resistant Cable

The wire and cable industry is a typical manufacturing industry; raw material prices account for 70% to 80%. Therefore, raw materials' advantages and disadvantages largely affect the quality of wire and cable products, and certain companies can provide ultra-low price products.
Some companies can offer low price products, but only in the raw materials, the quality of the product is very poor, the rise and fall of copper prices change, largely determine the price of wire and cable.

ZW cables can meet the standards of fire resistant cables From production, transportation, sales, and other quality control of the entire process, the test's raw material procurement aspects are very strict, the supplier's products, then the quality, price, and service.

All the company's fire resistant wire and cable performance indexes meet the International Electrotechnical Commission requirements and national standards and have been well received and recognized.

Difference between PVC- LSF-LSHF- FR- FRLS -FRLSH Cables. (PART-1)

Introduction:

- Due to lack of standardization and lack of awareness. While selecting of Cable, there is a lot of confusion and misunderstanding regarding the terminology associated with cables in terms of "LSF / LS" (Low Smoke), "LSZH / LSHF (Low Smoke Halogen Free)," FR" (Fire Retardant),"FR" (Fire Resistance) "FRLS" (fire resistant, low smoke), "FRLSZH" (Fire retardant Halogen-Free).
-

Cable / Wire Terminology

- According to type of Insulation Material around the conductor, we can classify Cables / Wire in Three main Categories PVC, Zero Halogen and Fire Retardant.
- According to application we can mainly classified in to Two categories

(A) Non-Fire Rated Cable

1. PVC = Polyvinyl Chloride
2. LS / LSF = Low Smoke / Low Smoke Fume
3. LSHF / LSZH / LSNH = Low Smoke Halogen Free / Low Smoke Zero (No) Halogen
4. LH / HF = Low Halogen / Halogen Free

(B) Fire Rated Cable

5. FR =Fire Retardant
6. FR =Fire Resistance
7. FRLS = Fire Resistant, Low Smoke
8. FRLSH= Fire Resistant, Low smoke, Low Halogen
9. FRLSZH / NHFR / ZHFR / HFFR = Fire Retardant Low Smoke Zero Halogen / Non (Zero) Halogen Free, Fire retardant
10. HRFR=Heat Resistance Fire Retardant

- PVC, FRLS and FP cables, have conductors and insulation to manage the electrical current and voltage. Some also have extra physical protection, like steel wire armour.
- PVC and FRLSH cables are different insulating materials around conductors for different application and performance.
- The properties that distinguish one electrical insulation from the other are
- (1) dielectric strength or break down voltage
- (2) maximum permissible temperature
- (3) dielectric loss
- (4) permittivity; and some special properties to suit the application.
- FRLS / FRLF is the quality of insulating material. It may be PVC or XLPE.

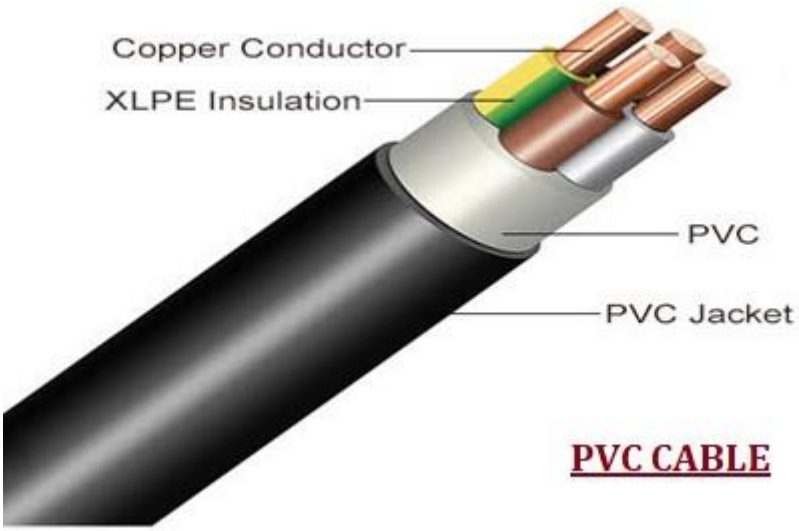
Flame &Fire Resistant for plastic Cable compounding applications. Retardant

(A) Non-Fire Rated Cable

(1) PVC Cable:

- PVC (Polyvinyl Chloride) cables is usually made up of a PVC compound as an insulating Material.
- PVC insulation has a temperature limit of about 70°C. From the point of view of maximum permissible temperature, it belongs to the lowest class of insulation, yet it serves the purpose as the voltages and power ratings involved are relatively low.
- While burring of PVC in case of Fire produces dense of black smoke and produce large amount of toxic gas and cocktail of harmful chemicals.
- **Smoke:**
- Burning PVC has been **reduced visibility in the surrounding area** by 50% within 10 minutes. After 30 minutes, visibility can be reduced by as 90%
- This reduced visibility could make it very difficult to escape a burning Area / Building.
- The smoke and fumes produced during a fire can be more dangerous to people than the fire itself.
- **Toxic Chemicals:**
- Burning PVC produces a number of toxic chemicals, but the most problematic is hydrogen chloride (HCl). **PVC emits approximately 28% of Hydrogen Chloride (HCl)**.
- In natural state HCL is a pungent, almost colorless gas, which forms into white vapor clouds on contact with air.
- Furthermore, when mixed with water it changes state yet again to form Hydrochloric Acid, whether it's in gaseous, vaporized or liquid state it's a highly toxic and corrosive substance.
- There are numerous harmful effects that HCl can have on a person. If inhaled the lining of the throat can be irritated to such an extent that it swells, making breathing extremely difficult.
- Contact with the eyes can be responsible for anything from severe irritation to permanent damage to the corneas. Similarly, lips and mucous membranes may be burned or even ulcerated, the severity dependent on the concentration of HCl and length of exposure.
- Taking into account the combined effects on someone of the smoke and HCl produced during the burning process, it's difficult to see and the victims have been rendered unconscious long before the flames have reached them.
- **Some extent Fire Retardant property:**
- PVC is resistant to Fire ignition.
- PVC (polyvinyl chloride) is naturally Fire Retardant due to chlorine base. It contains a large number of chlorine ions in the molecular structure and these are particularly difficult to break off when exposed to heat.
- If it does catch fire, PVC has a particularly slow spread of flame. PVC has one of the lowest flames spread ratings, meaning that it won't typically contribute to the spread of a fire
- The temperature required to ignite rigid PVC is more than 150 deg C higher than that required to ignite wood. **The ignition resistance of common flexible PVC formulations is lower, but with specialized formulations it may be significantly increased.**
- The fire in the gets extinguished immediately on removal of the fire source.
- In the Plant or Building, PVC cables are bunched in the cable shaft or on cable trays. In case of fire in these cables the fire becomes self-sustaining.
- Moreover, due to the burning of PVC a dense corrosive smoke is emitted which makes firefighting very difficult, due to poor visibility and toxic nature of the smoke. HCL content of the smoke, not only damages other costly equipment lying nearby, but also penetrates the RCC and corrodes the steel reinforcement.
- **PVC have some Fire retardant Property due to halogen even though it may create an extensive damage to the property and harmful for human**.

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant



Advantage:

- PVC is Cheap.
- PVC offers greater flexibility and robust
- PVC have a relatively long working life

Dis Advantage:

- When PVC insulated cable burns it gives off a cocktail of chemicals and dense black smoke.

Application:

- PVC cables are used for non-essential services that do not need to operate in case of fire
- Mostly use for Domestic, Office for general lighting.
- They are ideal for low-risk buildings, not generally for public or large commercial buildings.

(2) LS / LSF (Low Smoke & Fume) Cables:

- LSF is also manufactured using PVC compounds.
- LSF cables are usually made up of a modified PVC compound (varying degrees dependent on the manufacturer's) which produces somewhat less HCl gas and smoke on burning than PVC.
- However, it still produces **15% to 22 % (depending on quality) of HCl gas** and due to the presence of PVC can still emit dense black smoke and HCl emissions.
- It does contain halogen, so it shouldn't be confused or similar with Low Smoke Halogen Free (LSHF) cables.
- The amount of PVC present in these cables can differ from manufacturer to manufacturer which makes installing LSF cables in public place

Advantage:

- These cables are often purchased to cut cost or in confusion with LSHF cables.
- They should be considered to be a small improvement over PVC cables.

Dis Advantage:

- These cables are not recommended for public, large commercial buildings, near sensitive electronic equipment and where escape is limited in case of fire.

Application:

- Mostly use for Domestic, Office for general lighting.

Flame &Fire Resistant for plastic Cable compounding applications. Retardant

(3) LSHF / LSZH / LS0H (Low Smoke Halogen Free) Cables

- LSHF cables are made up of halogen free compounds that are good fire retardants but emit less than **0.5% hydrogen chloride** gas and smoke when burnt.
- In case of fire, LSHF cable produces only small amounts of light grey smoke and miniscule amounts of HCl, which as a result greatly increases a person's chances of escape from a burning building in which it's installed.
- The reason LSHF products react so differently when exposed to fire in comparison to PVC & LSF cables is the complete absence of PVC.
- The outer sheath / Jacketing and conductor insulation of these products are often made from polyethylene which contains little by way of chlorine, and low chlorine means low HCl and Low nontoxic gases emissions.
- **It emits <0.5 % of HCL gas thus providing a safer environment in the event of a fire.**
- There's no PVC in these cables, hence no harmful fumes or dense black smoke are given off in case of fire and generation ensures evacuation routes and signage remain visible during a fire.
- In Some Manufacture's LSHF Cable use standard PVC cables over-sheathed with an LSHF jacket or cables with PVC insulation. When the jacket burns through, the PVC inner sheath or insulation will give off poisonous gases in just the same way as PVC Cable.
-

LSHF - LOW SMOKE HELOGEN FREE CABLE

Advantage:

- LSHF cables use in applications where smoke emission and toxic fumes could a risk to human health and essential equipment in the event of a fire.

Dis Advantage:

- Costly compare to PVC and LSF
- Not Flexible compared to PVC

Application:

- Because of their low smoke and toxicity benefits, LSHF cables are often chosen for various Public, non / Poor ventilated Place and Essential applications.
- Public space, Building like Railway and subway stations and cars, buses and bus stations, airplanes and airports, Carrier Ships, other mass transit facilities.
- Any public underground or poorly ventilated location like elevators, subways
- Public entertainment and sports facilities
- Apartment buildings and hotels
- Hospitals
- Computer/data centers

Difference between PVC vs LSF vs LSZH

- LSF cables are flexible and low-cost alternative to PVC cables but made from a modified version of PVC and can still produce a dangerous amount of toxic gas and **large amounts of black smoke and hydrogen chloride gas when burned.**
- Black smoke can obscure exit routes in the event of a fire and hydrogen chloride gas can be deadly to both people and sensitive equipment.
- Whereas LSHF cables are less flexible and a higher cost but **due to absent of PVC reduce significant of toxic gas, smoke and no more than 0.5% HCL when burned**. So in a high risk populated area where escape is limited, LHSF cables are strongly recommended.
- But in low-risk areas where the evacuation is easy and high flexibility is required, PVC could still be a good choice.
- One common misunderstanding is that LSF or LSHF cable is also flame retardant. This is not necessarily true. The cables may spread the fire even though minimal fumes are being emitted

Flame &Fire Resistant for plastic Cable compounding applications. Retardant

Difference between PVC- LSF-LSHF- FR- FRLS -FRLSH Cables. (PART-2)

(B) Fire Rated Cable (Retardant / Resistance Cable)

- Fire is one of the biggest risks in factories, public place and a majority of them occur due to electrical faults.
- The terms Fire Resistant and Fire Retardant (both are commonly referred to as FR) terms are very similar and misused or confusing a lot.
- Both are different in structure, in materials, in Application and react even differently in the event of a fire. If we required one but select other can lead the problem.
-

(1) Fire Retardant Cables

- Insulating Material of Fire Retardant Cable is chemically treated to Retard or Slowdown ignition or Burning of Fire hence **slow down the spreading of fire.** It also actually self-extinguishes when exposed to an open flame.
- **Flame-retardant Cable is characterized by delaying the spread of flame along the cable so that the fire does not expand.**
- Fire-resistant cables and flame-retardant cables are different in structure and materials.
- The basic structure of the flame retardant cable is:
- The insulation layer uses flame retardant.
- The inner sheath and outer sheath are made of flame retardant.
- The tape and filling use of flame retardant material.
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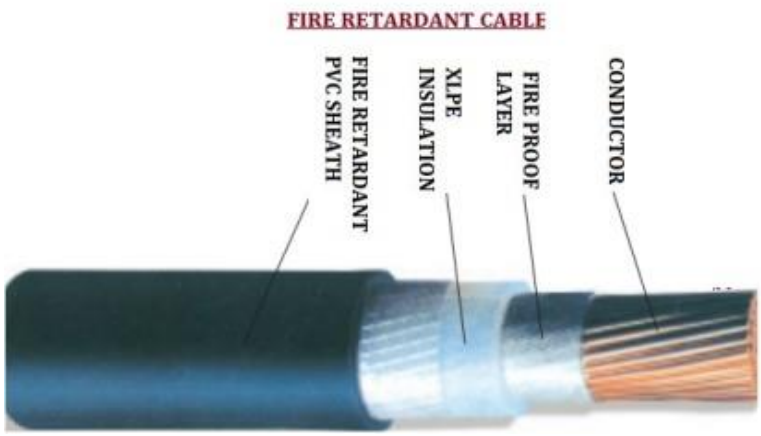

Advantage:

- Low Cost compared to Fire Resistance Cable.
- Produce Low Smoke

Disadvantage:

- **By Adding Fire Retardant Material / Filler in PVC it decreases insulation property at least 10% compare to normal PVC**, however its conductor temperature withstanding capability (during overload) remains only at 70 deg C same as ordinary PVC cables.

Applications:

- Control Wiring of Building
- Fire Alarm Circuit

(2) Fire Resistant cables

- The Fire resistance materials (non-flammable.) are designed to prevent / Resist the spread of fire (self-extinguishing) and will not melt or drip when in close proximity to a flame.
- Because it self-extinguishes once the source of ignition is removed and does not melt or drip. **Fire-resistant cables can maintain normal operation for a certain period under flame burning conditions and maintain the Circuit integrity and continue to work for a specified period of time under defined conditions hence improving the chances of escape and survival.**
- Because of Fire resistant fabrics are not usually made from 100% flame resistant materials, they will burn, but will do so very, very slowly and are often self-extinguishing.

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

- A Fire-resistant cable is a cable that can maintain safe operation for a certain period under flame-burning conditions. Fire-resistant wires are widely used in high-rise buildings, subways, underground shopping malls, power stations, and important industrial and mining enterprises related to fire safety and fire rescue. For example, power supply wires and control wires for firefighting facilities.
- Fire-resistant cable is divided into class A and class B.
- **Class B:** Class B cable can be in 750 ℃ to 800 ℃ flame and rated voltage to withstand burning for at least 90min, and the cable is not broken.
- In the refractory layer to improve the manufacturing process and increase the refractory layer and other methods based on
- **Class A:** Class A fire rated cable can be 950 ℃ to 1 000 ℃ flame and rated voltage to withstand burning for at least 90min and the cable is not punctured.
- Class A fire-resistant cable fire performance is better than class B.
- **Mineral Insulated Cable (MI):** mineral insulated cable is a better performance of fire-resistant cables made of copper core, copper sheath, magnesium oxide insulation material processing, referred to as MI (mineral insulated cables) cable.
- MI cable has good fire resistance characteristics and can work for a long time under 250 ℃ high temperature, but also explosion-proof, strong corrosion-resistance, high flow rate, radiation resistance, high mechanical strength, small size, lightweight, long life, and smokeless. However, the price is high. The process is complicated, the construction is difficult in the oil irrigation area, important public buildings, high-temperature places, and other fire-resistant requirements, and the economy can accept the occasion and use fire-resistant cable.

Advantage:

- Produce Low Smoke compared to Fire Retardant Cable.

Disadvantage:

- High Cost compared to Fire Resistance Cable.
- By Adding Fire Retardant Material / Filler in PVC it decrease insulation property at least 10% compare to normal PVC, However its conductor temperature withstanding capability (during overload) remains only at 70 deg C same as ordinary PVC cables.

Applications:

- In Fire Fighting System,
- In Fire Alarm Circuit

(3) FRLS (Fire Retardant Low Smoke)

- To overcome these deficiencies of FR Cable, FRLS Cable was developed.
- FRLS has special flame retardant, low smoke emitting and toxic fumes suppressing properties.
- In FRLS Cable, inner sheath and/or outer sheath is made material of Polyethylene Material having Fire Retardant Properties.
- In the Case of fire, convectional PVC insulated wires give out thick black smoke and toxic fumes of hydrochloric acid gas. This impairs visibility and hampers rescues operations. But in FRLS Cable not only emits very little smoke and toxic gases, but also retards the spreading of fire. It is thus ideal of concealed and conduit wiring in multi-storied high-rise buildings such as hotels, banks, hospitals, factories, commercial complexes and residential apartments, etc

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

Advantages

- Excellent flame-retardancy
- Low smoke generation
- Low toxic gas emission

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

(4) FRLSZH/ NHFR / ZHFR (Fire Retardant Low Smoke Halogen Free)

- FRLSZH, Halogen Free Flame Retardant non-toxic smoke house wires for building wiring.
- FRLSZH Wires are recommended especially in a situation where high degree of safety of personnel and equipment are obligatory like Hotels, Theatres, Hospitals, High-rise buildings, Commercial complexes, Centrally A.C. offices, Residential properties etc.
- Owing to its special insulation characteristics the wires continue to provide uninterrupted power supply even during fire – keeping alive fire alarm circuits, exit lights, Lifts & other emergency Circuits.

- As part of sustainable green building technology, to bringing down the use of hazardous PVC from green building. Normal PVC cables will be replaced with Green Cab

Advantages

- Excellent flame-retardancy
- Halogen Free
- Low smoke generation
- Low toxic gas emission
- Better visibility help easy for people escape
- Environment friendly
- Benefit to environment
- PVC is not only hazardous during the manufacturing process but also potential risk in case of fire. Green Cable is superior performance cable with utmost quality which is replacement for PVC cables.
- Generally used where green environment and higher safety is expected for Human life and valuables

Disadvantages

- Costly Compare to FR and FRLS Cables

Applications:

- Airports
- Centrally A. C. Buildings
- Complexes
- Educational Institutions
- General House wiring
- Green Buildings
- High Raise Building
- Hospitals
- Hotels
- Public Places, Theaters

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

Flame retardant (FR) or FRLS compounds are not suitable for building wires for the following reasons:-

- FR & FRLS PVC compounds are said to be flame retardant because they have better LOI (Limiting Oxygen Index) and TI (Temperature Index) than ordinary PVC, but, only better LOI & TI does not guarantee better flame retardant properties. LOI & TI are only quality control tests and flame retardant testing is incomplete without finished cable testing as per IEC 332-1 &3.
- Moreover, all the FR and FRLS PVC compounds contain Antimony Trioxide which is a probable carcinogen. When inhaled, ATO can cause irritation of the respiratory track, mouth, nose & stomach. It may also cause the heart to beat irregularly or even stop.
- The use of FR & FRLS PVC compounds does not solve the issues of dense black smoke and HCL acid gas emitting from burning which are the main cause of loss of human lifes during fire accidents.
- All PVC,FR & FRLS compounds also contain phthalate plasticizers. These plasticizers leach out of PVC compound after some time and results in PVC loosing its flexibility and other properties. Moreover most of the phalates presently used have been identified as suspected endocrine disrupters and reproductive toxicants

Difference between Fire Resistant vs. Fire Retardant Cable

- **Fire Resistant** and **Fire Retardant cables** are being used increasingly due to their usefulness in the event of fire. However, though they both sound similar, they have vastly different uses and react differently in the event of a fire.
- **Heat resistant:** It will operate as normal at high temperatures, but may not operate as normal in the event of a fire.
- **Fire retardant:** It will not operate as normal within fire conditions, but will actively prevent the fire from spreading.
- **Fire resistant:** It can operate as normal within fire conditions.
- **Conclusion:**
- In brief, Fire retardant cables are designed to resist the spread of fire into a new area. It would not maintain circuit continuity for Work.
- Fire resistant or fire rated cables are designed to maintain circuit integrity and continue to work, allowing power to be transferred through it under defined for a specified period of time and conditions.
- The distinction between the two is crucial when it comes to maintaining critical circuits required for life safety or for a safe and immediate plant shutdown.
- Fire resistant cables are used in critical electrical circuits, such as safety circuits and life support circuits which are required to function in the case of emergencies.
- Flame retardant cables on the other hand are used in all other circuits so if there's a fire, they can curb its spread. A flame resistant cable will be passed as per IEC 60331 and are encased in a red outer sheathes. Flame retardant cables behavior under fire is predefined as per passing the IEC 60332 and are encased in a grey or black outer sheathe.

Fire resistant (fire rated) cables	Continues to operate in the presence of fire, hence their reference as Circuit Integrity cables.
Flame retardant cables	Fire performance limited to not propagating fire

Difference between FR vs PVC vs LSF vs LSHF Cables

- **FR Cables:**
- Fire resistant and fire retardant cable sheaths are design to resist combustion and limit the propagation of flames.
- **Fire Retardant (FR):** Designed for use in fire situations where the spread of flames along a cable route needs to be retarded
- **Fire Resistant (FR):** cables are designed to maintain circuit integrity of those vital emergency services during the fire
- **FR is for essential services such as fire alarms, emergency lighting, life safety and firefighting applications.**

Flame &Fire Resistant for plastic Cable compounding applications.

Retardant

- These systems have to operate during a fire to detect the fire, alert people and help them evacuate and also help emergency services do their job.
- These circuits need to function fully and retain circuit integrity in the event of fire.
- In case of fire, it does not emit toxic or corrosive gases, thereby protecting public health and avoiding any possible damage to electronic equipment
- **LSF, LSHF and PVC Cables**
- Low smokes cables have a sheath designed to limit the amount of smoke and toxic halogen gases given off during fire situations
- **Low Smoke and Fume (LSF):** burns with very little smoke and fumes compared to standard PVC, fumes may contain halogens
- **Low Smoke Zero Halogen (LSZH):** when burns there is very little smoke and fumes contains no Halogen (compared to standard PVC)
- **LSHF and PVC cables are used for non-essential services that do not need to operate in a fire.**
- These include all the usual power circuits in buildings for services such as general lighting or kitchen and office appliances like cookers or photocopiers.
- These circuits are not essential for the safety of the public; they can fail in a fire with no increase in danger so they do not need to be fire resistant.
- For public buildings however, all cables need to be low smoke and zero halogen type but in domestic premises and for buried cables they do not, so PVC is acceptable
- Both LSZH and LSF are used to limit smoke, fumes and halogen given off in fire conditions.
- In the event of a fire, both types will emit very low levels of smoke. LSF cable will emit toxic gases while LSZH will limit the emission of these (typically under 0.5% hydrogen chloride emission). In addition to being toxic, hydrogen chloride is corrosive to equipment. The use of LSZH cables protect both people and limit the amount of equipment damage during a fire situation.

Comparison of various cable

Comparison of various cable

Feature	Normal PVC Wire	Heat Resistant HR PVC	Fire Retardant FR – PVC	Fire Retardant Low Smoke FRLS	Zero Halogen Low Smoke ZHFR
Insulation Material	PVC	PVC	Special PVC	Special PVC	Special Polymer
Insulation Property	Normal	Good	Good	Good	Very Good
Temperature Rating	70^0 C.	85^0 C.	70^0 C.	70^0 C.	85^0 C.
Thermal Stability	Normal	Very Good	Good	Good	Very Good
Flam Retardancy	Good	Good	Very Good	Very Good	Excellent
Safety During Burning	Average	Average	Good	Good	Excellent
Requirement of Oxygen to Catch Fire	> 21%	> 21%	> 30%	> 30%	> 35%
Temperature Required to catch fire (with 21% oxygen)	Room Temp.	Room Temp.	> 250^0 C.	> 250^0 C.	> 300^0 C.
Visibility during Cable burning	< 20%	< 20%	< 35%	< 40%	< 80%
Release of Halogen Gas during burning	< 20%	< 20%	< 20%	< 20%	0%

Flame &Fire Resistant for plastic Cable compounding applications.
Retardant

Abrasion Resistance during Installation	Good	Good	Good	Good	Good

Comparison various Specification's of Cable

Test	Function	Specification	Values of FRLS Compound	Values of Halogen Free Compound	Values of PVC
Critical Oxygen Index	To Determine % of Oxygen Required For Supporting Combustion of Insulating Material at room temperature.	ASTM–D-2863	> 29%	More than 29%	23%
Temperature Index	To determine at What Temperature Normal Oxygen Content of 21% In Air will Support Combustion of Insulating Material	ASTM–D-2863	> 250^0 C.	More than 250^0 C.	150^0 C.
Smoke density Rating (Light Transmission)	To Determine the visibility (Light Transmission) under Fire of Insulating Material	ASTM-D-2843	> 40 %	More than 80 %	10-15 %
Acid Gas Generation	To ascertain the amount of Hydrochloric Acid Gas Evolved from insulation of Cable Under Fire.	IEC – 754 – 1	< 20 %	Less than 0.5 %	45-50 %

International Standards

Halogen & Smoke Emission, Corrosively & Toxicity Standards

- IEC 60754-1/BS6425-1 – emission of halogen
- IEC 60754-2 – corrosivity , Acid gas emission
- IEC 61034-1/ ASTM E662 – emission of smoke
- ISO4589-2/ BS2863 – oxygen index LOI
- ISO4589-3/ BS2782.1 – temperature index TI
- ASTM – D – 2863- Oxygen index
- ES713 – toxicity index

Flame Retardant Standards

- IEC 60332-1 / BS 4066-1 – flame test on single vertical insulated wires/cables
- IEC 60332-3 / BS 4066-3 – flame test on bunched wires/cables
- UL Standard for Fire Retardant Cable
- NFPA -262 =CMP (Plenum Flame Test/ Steiner Tunnel Test)
- UL1666=CMR (Riser Flame Test)
- UL 1581=CM (Vertical Tray Flame Test)
- UL1581=CMG (Vertical Tray Flame Test)
- UL1581=CMX (Vertical Wire Flame Test)

Fire Resistance Standards

- IEC 60331 – fire resistance test
- BS 6387 / BS 8491: BS 8434/2 – fire resistance test (more stringent than IEC 60331)